

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210

MIDTERM EXAM II

12/91Po

- This exam is open book and notes.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be sure to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.
- Enter your name in the space provided.

1	
2	
3	
Total	

Name: _____

1. Consider a laser with a small-signal round-trip gain of 0.12 and a round-trip internal loss of 0.055. It operates with one mirror partially reflecting and the other mirror totally reflecting. Calculate the ratio of the output power when the output-mirror reflectivity is 96% to the output power when the output mirror has the optimum reflectivity.

2. A laser operating at $1.0 \mu\text{m}$ is Doppler broadened with an equivalent temperature of 400K and has a frequency linewidth of 18 GHz. The index of refraction of the lasing medium is 1.10. Calculate the value of the saturation irradiance at the frequency $\nu = \nu_0 - (\Delta\nu/2)$.

3. Consider a diode laser with the properties listed in the table below. Calculate the threshold population difference density $\Delta N/\text{Vol}$ for this laser.

Parameter	Value
α_{int}	10 cm^{-1}
L	$500 \mu\text{m}$
λ	$0.84 \mu\text{m}$
Broadening	Lorentzian
$\Delta\nu$	$1.5 \times 10^{13} \text{ Hz}$
τ_s	10 ns
R_1	32%
R_2	32%
n	3.6